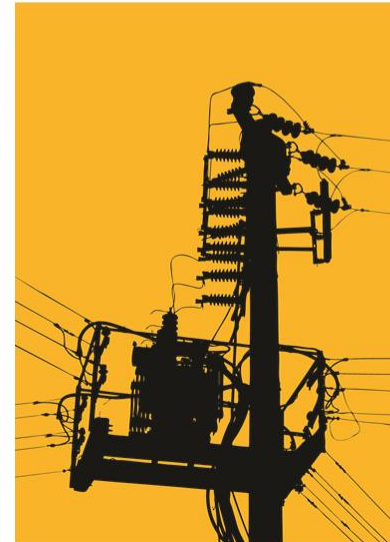




Systems to Implement Demand Response in New Zealand

By Dr. Richard Strahan and Dr. Allan Miller



What is Demand Response (DR)?

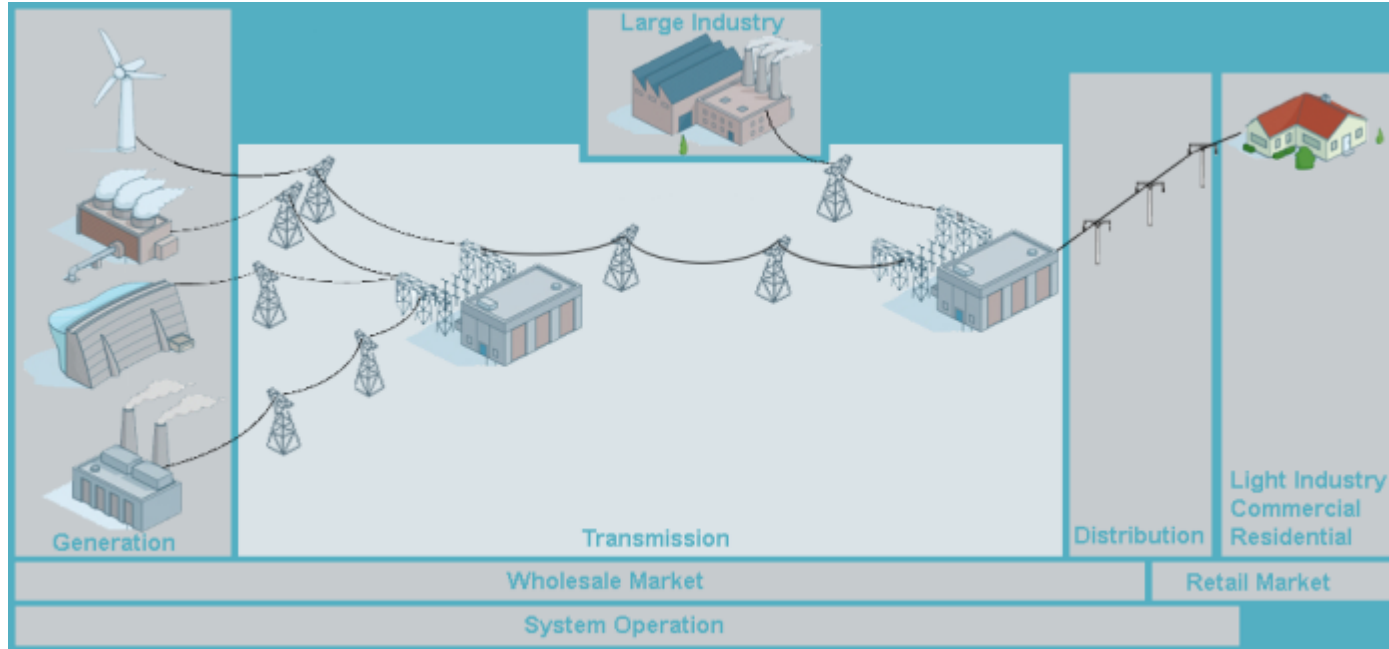
To keep the lights on, especially during peak times, requires:

$$\text{Supply} = \text{Demand}$$

According to the Federal Energy Regulatory Commission, Demand Response (DR) is defined as:

“Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.”

Forms of DR



Nodal Pricing – wholesale energy market

- Generators offer energy at over 50 Grid Injection Points
- Power is fed off the grid at over 200 Grid Exit Points (GXPs)
- Generator offers of energy, offers of instantaneous reserve, and load forecasts are input into the System Operator's (SO's) Scheduling, Pricing & Dispatch (SPD) tool to schedule, price, and dispatch energy in the most economic manner for the benefit of retailers and end-users.
- 12 non-conforming GXPs where the user provides their own forecast to the SO.
- Remaining conforming GXPs where demand side does not bid and load is centrally forecast by SO.
- Generators 'compete' on the supply side. But is there sufficient interaction with supply from the demand side (e.g. retailers and large users)?

Demand Side Bidding & Forecasting (DSBF)

- The current key features of nodal pricing were implemented by introduction of DSBF.
- Created two schedules called Price-Responsive Schedule (PRS) and Non-Response Schedule (NRS).
- As mentioned purchasers at conforming GXPs have their load forecast by the SO, but they can bid price into the PRS as *difference bids*.
- Aims to improve the inputs into the price forecast schedules to improve accuracy. This allows better use of generation & DR capability.
- Electricity Authority: There has not been a great uptake in purchasers submitting difference bids.

Dispatchable Demand (DD)

- It is the demand side complement to the supply of dispatchable generation.
- Due May 2014.
- Allows large end-users at any GXP to submit nominated bids and subject their load to dispatch for every half hour trading period.
- Bids can be of dispatch or non-dispatch type.

Demand Response Initiatives

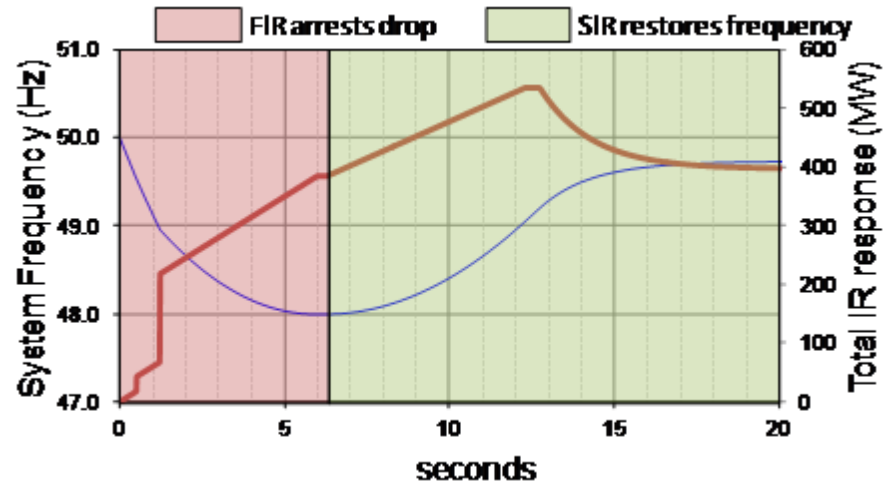
- Transpower initiative to defer transmission investment by using DR.
- Operates outside of the wholesale market.
- Participants curtail their demand when called upon, and receive a call payment.
- Successful: over 200 MW finally obtained in Upper North Island for 2013.
- The Commerce Commission has approved expanding the programme nationwide.

Interruptible Load (IL)

- Is a form of Instantaneous Reserve (IR), and is shed automatically by frequency controlled relays when the grid frequency falls below 49.2 Hz.
- Is essential for covering the security risk associated with the supply of energy.
- On the demand side, IL is provided by industrial and commercial end-users who receive payments.

What happens without IL?

Interruptible Load (IL)



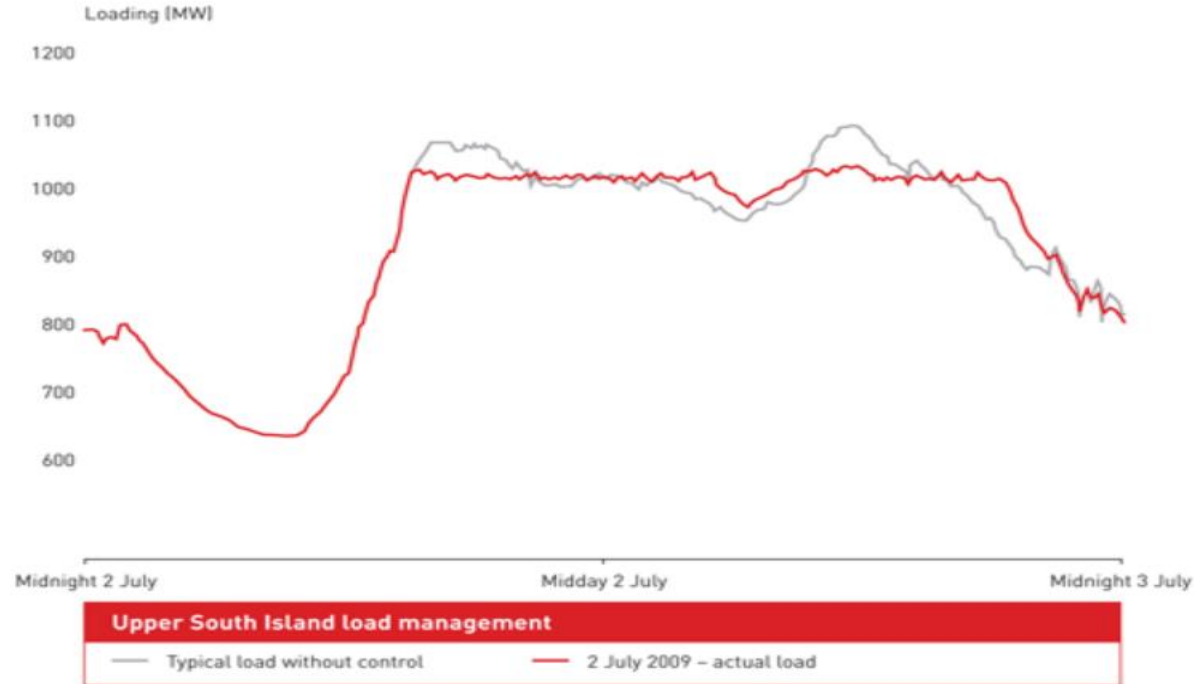
DR at the Retailer

- Load Shifting (retailers contract distribution companies).
- Procurement of IL.
- Curtailable Load (EnerNOC aggregating for Genesis in lower North Island).
- Tariff based DR (Genesis has introduced Advanced Metering Infrastructure with Time of Use tariffs for domestic customers).

Orion NZ Ltd

- Ripple control for various load types (e.g. hot-water, irrigation curtailable load)
- Orion uses DR in Canterbury to
 - A. Defer capital expenditure.
 - B. Maintain an N-1 security standard or better.

DR at the Distribution Level



The Lines Company

- TLC is installing its own smart-meters to bill domestic customers using a peak demand component.

Vector

- Introduction of a domestic PV scheme which includes battery storage.

- Home Energy Management Systems (HEMS) have been defined as any product or service that monitors, controls, or analyzes energy in the home, and may be utility or non-utility based.

Systems for DR Implementation

- **Nodal Pricing/DSBF:**
 - Retailers and large users can plan DR according to the Schedule Prices.
 - Communication system is the Wholesale Information & Trading System (WITS).
- **Dispatchable Demand:**
 - Bids and offers make a market so get DR.
 - Communication system is WITS and required to be a Dispatch Capable Load Station.
- **Transpower DR:**
 - Communication via the Demand Response Management System using Alstom's DRBizNet platform, using Email, web-browser, or automated internet computer-to-computer connection.
 - TOU smart meter for participant.

- **Interruptible Load:**
 - EnerNOC: DemandSMART IL infrastructure. Metering & data server & automated switch at participant's facility.
 - Communication to participant: web-browser, SMS, Email.
- **Distribution Companies:**
 - Ripple: system of relays activated by ripple channel signal.



11 kV ripple injector

The Future

- **Transpower DR:**
 - Transpower is willing to offer the DRBizNet to Retailers and Distribution companies for their own DR purposes.
 - DRBizNet platform has the capability to be used in homes.
- **Further roll-out of smart-meters and HEMS into homes:**
 - Meters enable tariff based pricing e.g. Time of Use, Critical Peak, Real-Time Pricing.

Conclusion

- These initiatives form a rapidly emerging fabric of DR systems in NZ allowing benefits of deferral of investment, better integration of renewable generation, and improved security of supply.

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